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Inventory Management for Air Force Advanced Academic Degree Officers

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Graduate School of Engineering and Management

23 June 2005

- ## Introduction
  - GEMS/AADS Background
  - Inventory Modeling Approach

- ## AADIM-E
  - Education Profiles
  - Quota Recommendations
  - AADIM-E Insights

- ## AADIM-U
  - Assignment Problem
  - Qualification Matrix
  - AADIM-U Insights

- ## Conclusions and Future Directions

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- Graduate Education Management System (GEMS)
  - Guidance
    - DODD 1322.10, 26 Aug 04
      - Allows each service to manage their own graduate education programs
    - AFI 36-2302 , 11 Jul 01
      - Source document for GEMS
  - Specific unit positions are coded and revalidated at least biannually
    - "Bottom up
  - Projected vacancies are basis for graduate education quotas

- System is well designed to justify education requirements
  - "One billet, one body"
  - Incumbency rates are measurable
  - Service Commitment fulfillment rates are measurable

- System is poorly designed to develop officers
  - Officers move from AAD billet
    - Professional Development
    - Dynamic unit environment
    - AAD billets are not backfilled and commanders will delete AAD coded billets

- "Bottom-Up" approach is problematic
  - Specific billets are coded when actual requirement is for a level of expertise within a unit
  - Not consistent across units, wings, MAJCOMS
  - No grand strategy exists
- Despite design for accountability, GEMS/AADS does not adequately achieve or monitor goals
  - Historical billet incumbency rate: 50-60%
    - Tracking problems, e.g., no credit given for serving in related specialty billets
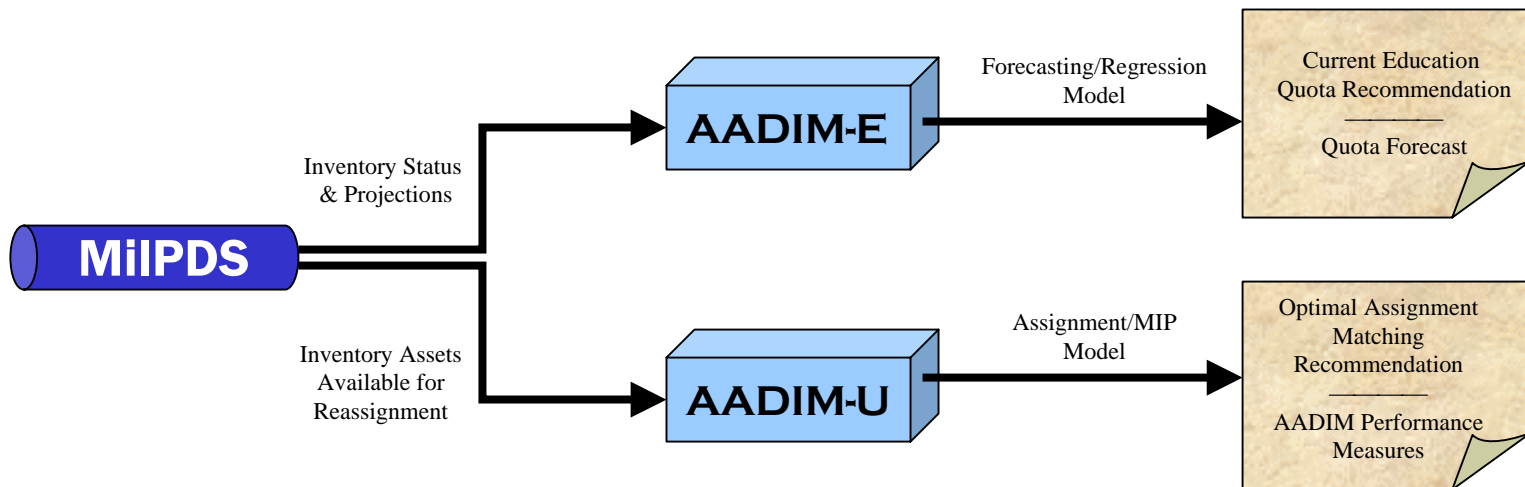 - AAD officer payback—most don't complete the 36-month requirement

- Development Teams provide an opportunity to develop a grand strategy
  - "Health" of each career field
  - Centralized guidance from Career Field Managers (CFM)
    - Primary advocate for career field specific and officer development
  - Career field representatives from cross-section of the AF
  - Long-term planning approach
- Developmental Education Initiatives
  - Paradigm Change: Officers are educated to enhance overall development, not just to qualify for the next job
  - IDE: no billet system for assigning these AFIT graduates

- ## Model is partitioned into two sub-models
  - ### AADIM Entry (AADIM-E)
    - Requirements Definition (aggregate educational profiles)
    - Quota generation for new AAD inventory entries
  - ### AADIM Utilization (AADIM-U)
    - Assign AAD officers to maintain optimal unit profiles

MiIPDS

Inventory Status & Projections

Inventory Assets Available for Reassignment

AADIM-E

AADIM-U

Forecasting/Regression Model

Assignment/MIP Model

Current Education Quota Recommendation
————
Quota Forecast

Optimal Assignment Matching Recommendation
————
AADIM Performance Measures

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AADIM-E: "Ideal" Educational Profiles

- Baseline for examination of the current and forecasted AAD inventories

- Two types of educational profiles
  - Career-field critical education
    - Officers obtaining these AADs are inventoried
  - Career-field enhancement education
    - Officers obtaining these AADs are not inventoried

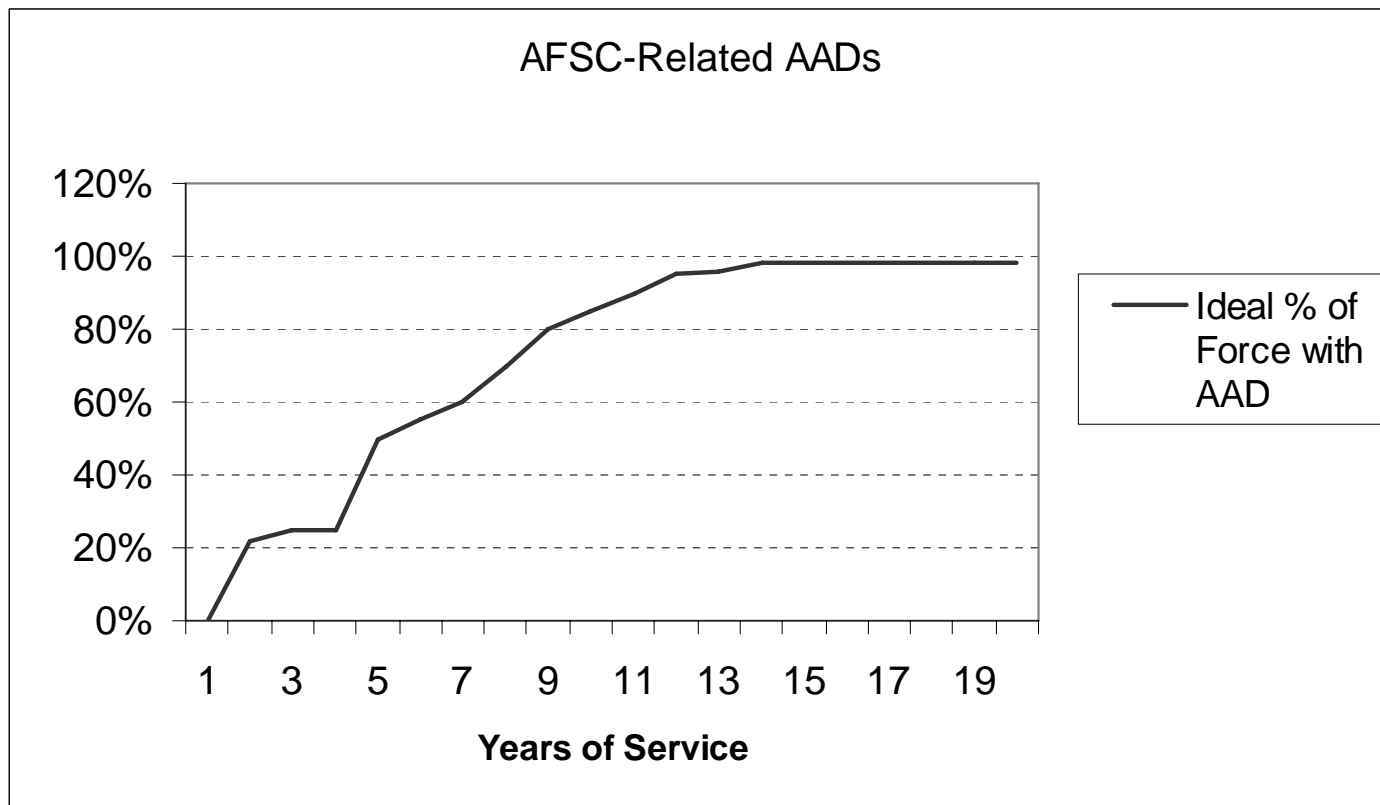# AADIM-E: "Ideal" Educational Profiles

- Two Approaches
  - Senior Rater: "At least x% of my 13S officers should have an advanced degree in a discipline that satisfies an appropriate subset of educational competencies."
  - CFM: "An educationally healthy 13S career field should have y% of its officers with an advanced degree that satisfies an appropriate subset of educational competencies."

- Complimentary approaches yield aggregate profile for each career field
  - Former approach reflects unit requirements, e.g., an ops wing has different needs than a MAJCOM staff
  - Latter approach reflects aggregate time-phased (by CYOS) career field needs

AADIM-E: "Ideal" Educational Profiles

- Example "Idealized Career Field Profile"
  - Each career field is unique, but will have similar functional form

AFSC-Related AADs

AADIM-E: "Ideal" Educational Profiles

- Assignment sequence of ops/staff tours through CGO years
  - Each time officers are available for assignment a fixed percentage is sent to graduate school
  - Preliminary model assumes a constant "selection rule"
  - Different rules can be utilized for each assignment timing
- Two-directional model
  - "Assignment Rule" yields Notional Profile
  - Desired Notional Profile yields "Assignment Rule"
- Inventory Factor (IF): Percentage of officers holding a career field related AAD for a given CYOS
- Aggregate Idealized Educational Profile ($\overline{IF}$)

$$\overline{IF} = \frac{\sum_{i=1}^{n} IF\,(CYOS = i)}{n}$$

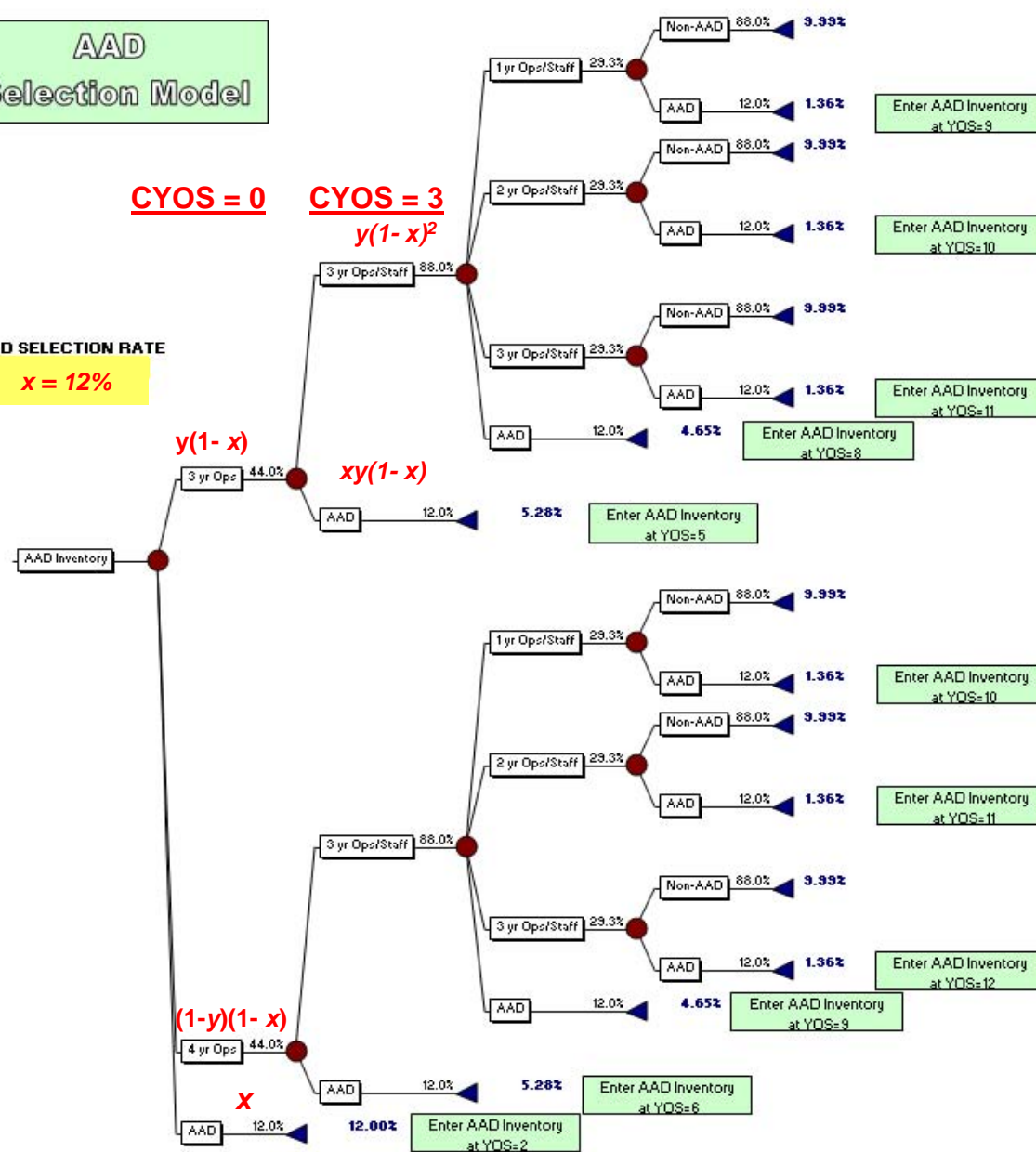AIR FORCE INSTITUTE OF TECHNOLOGY
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AAD Selection Model

CYOS = 0 CYOS = 3

AAD SELECTION RATE
x = 12%

Initial Tour Length:
[y=3 yrs, (1-y)=4 yrs]
y = 50%

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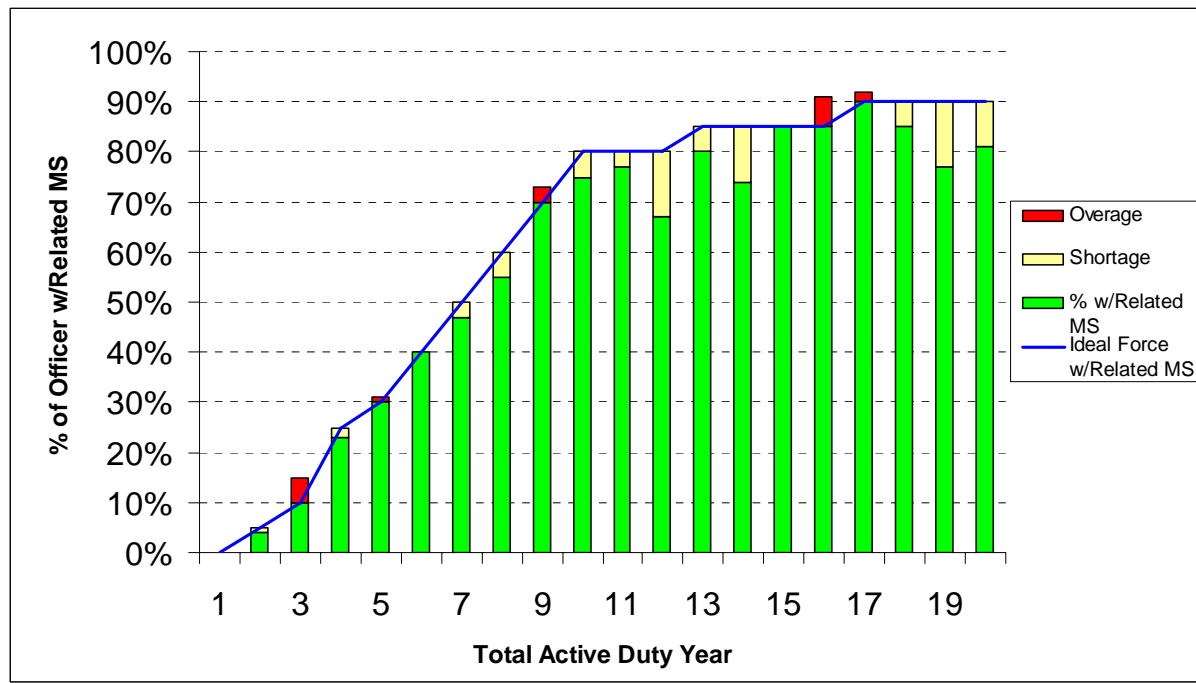
Notional AAD Profiles
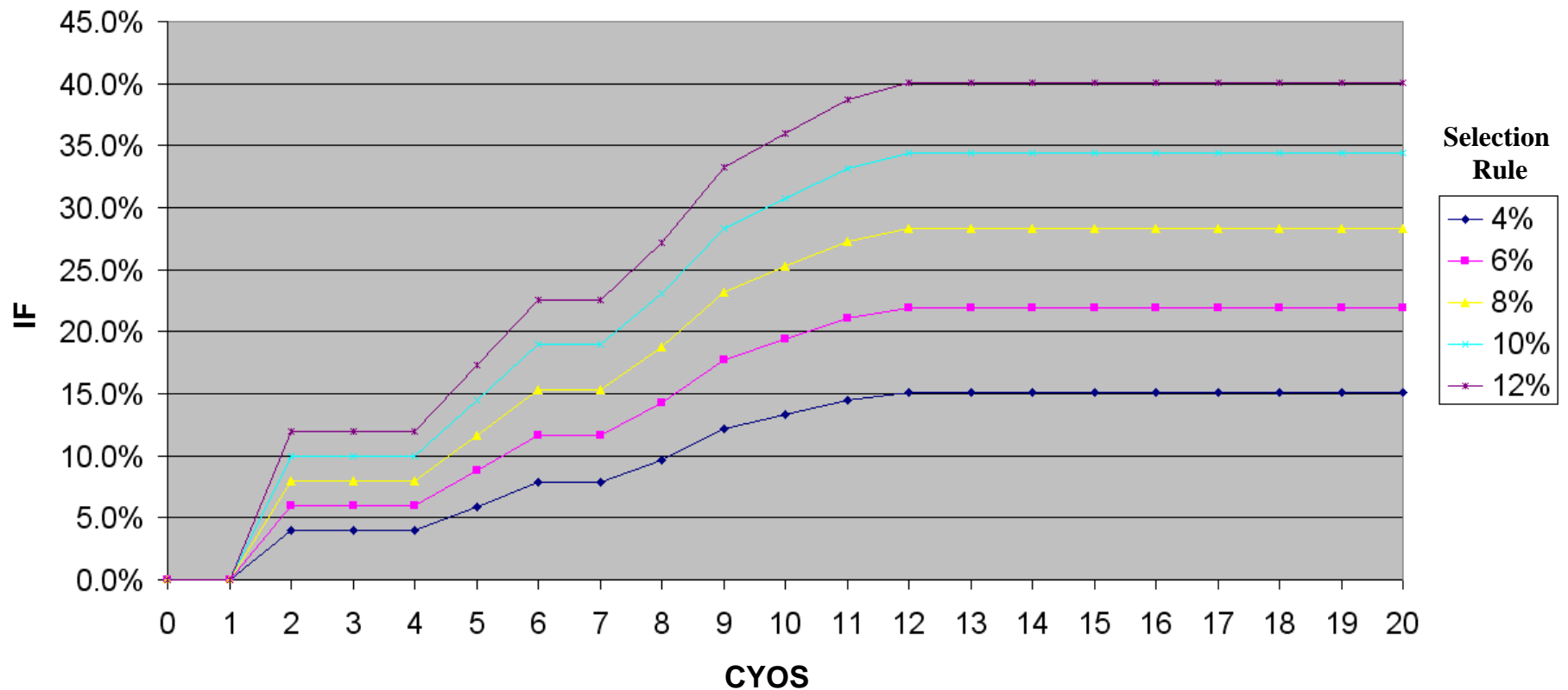
AADIM-E: Quota Recommendation

- Compare "Ideal" with actual MilPDS data
  - Delta between ideal and current profiles indicates educational needs
  - Provides the basis for a quota recommendation

# AADIM-E: Quota Recommendation

- Educational assignment alternatives for Inventory Entry
    - Career Field specific needs
    - Officer career timing for entry to AAD inventory
    - Officer preferences (T-OPD)

- Multiple year output—current FY plus projected
    - Requirements visibility facilitates long-term DT, AFPC and AFIT planning, as well as "advertising" to interested officers

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Idealized Educational Profile and
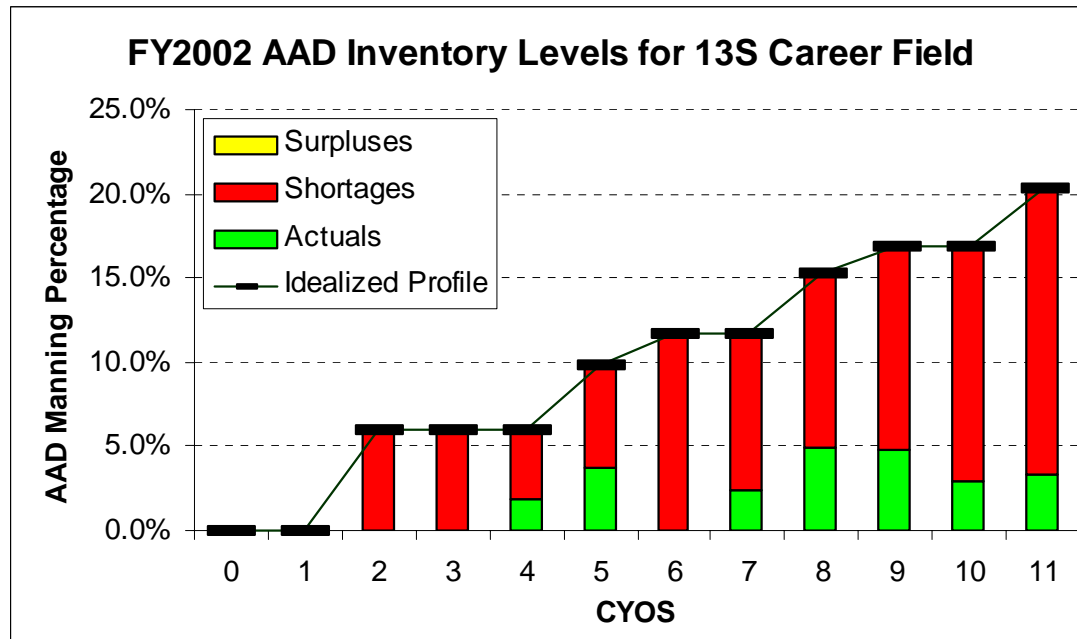# Actual AAD Inventory for 61S Career Field

- Percentage selected to attend graduate education each cycle = 20%
- Percentage with initial 3 year assignment = 50%
- $\overline{IF}$ = 30%
- Actual Aggregate AAD Inventory Percentage for FY02 = 10.6%

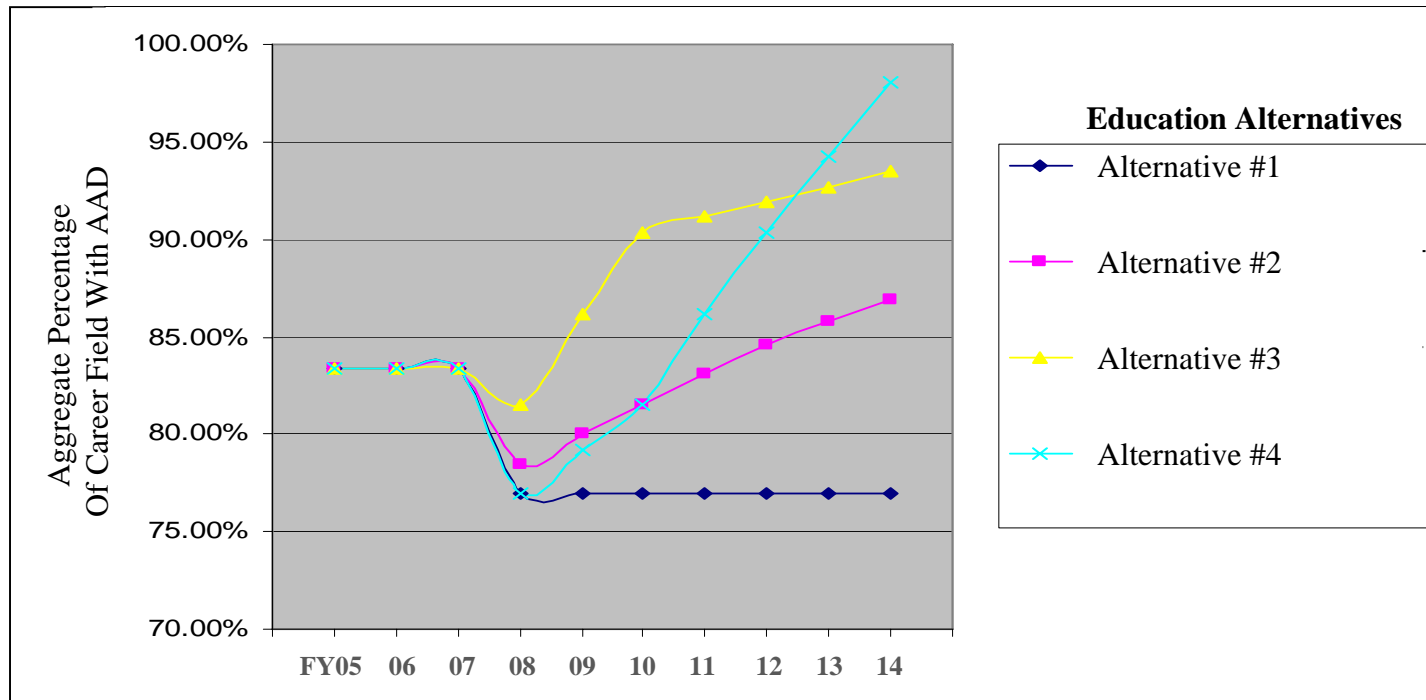**FY2002 AAD Inventory Levels for 61S Career Field**
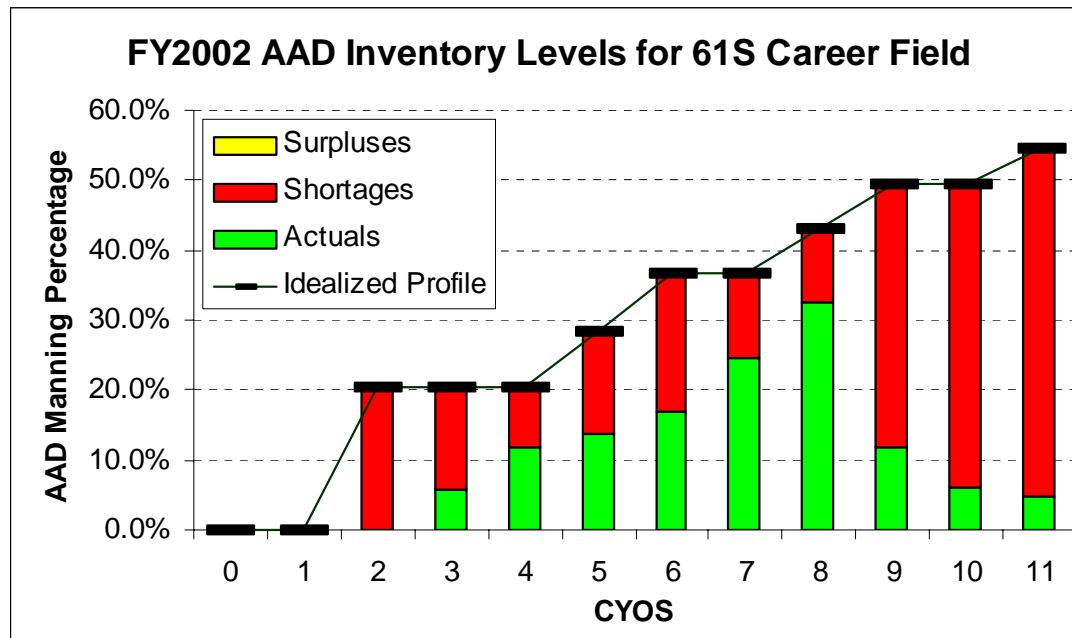
Idealized Educational Profile and Actual AAD Inventory for 13S Career Field

- Percentage selected to attend graduate education each cycle = 6%
- Percentage with initial 3 year assignment = 67%
- $\overline{IF}$ = 10%
- Actual Aggregate AAD Inventory Percentage for FY02 = 1.7%

FY2002 AAD Inventory Levels for 13S Career Field

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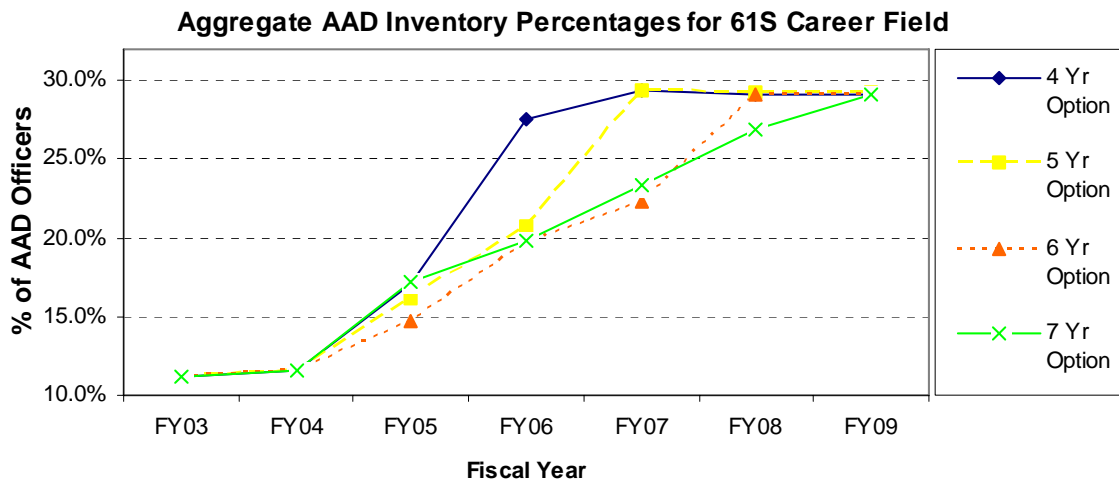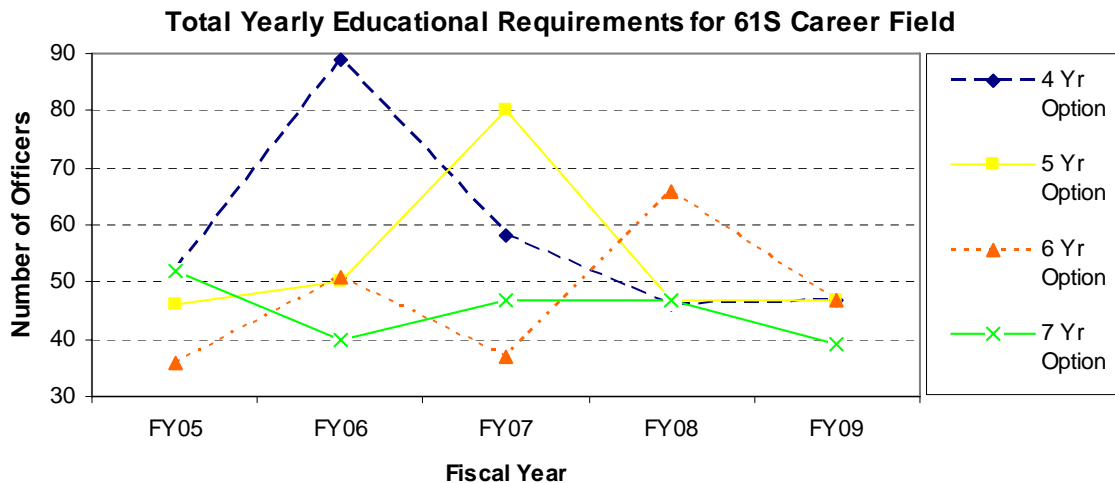Graduate School of Engineering and Management

- Graphical Analysis of Alternatives

Forecasted Educational Requirements: 61S

Total Yearly Educational Requirements for 61S Career Field

Aggregate AAD Inventory Percentages for 61S Career Field

Total Yearly Educational Requirements for 13S Career Field

Aggregate AAD Inventory Percentage for 13S Career Field

Forecasted Educational Requirements: 13S

Total Yearly Graduate Education Requirements for 13S Career Field

Aggregate AAD Inventory Percentage for 13S Career Field
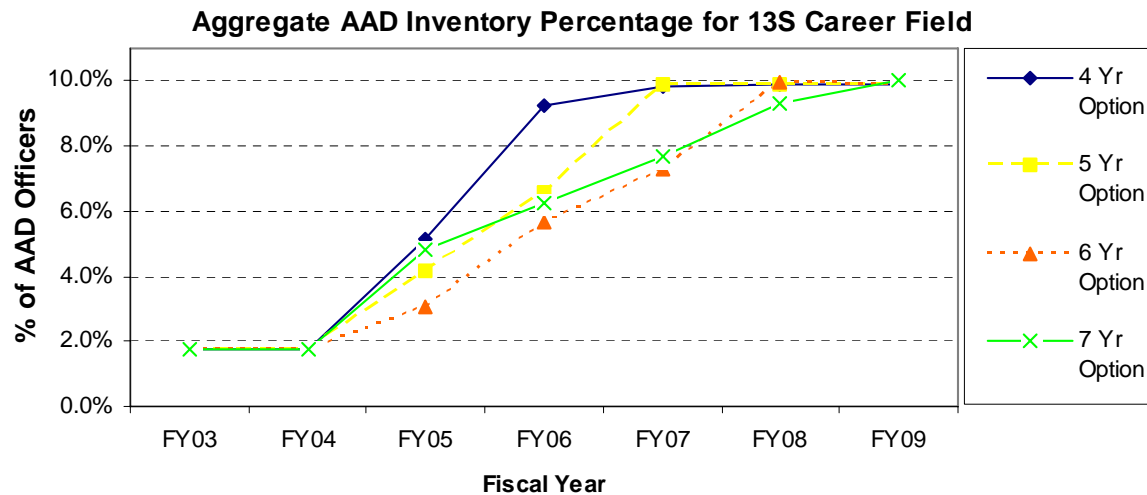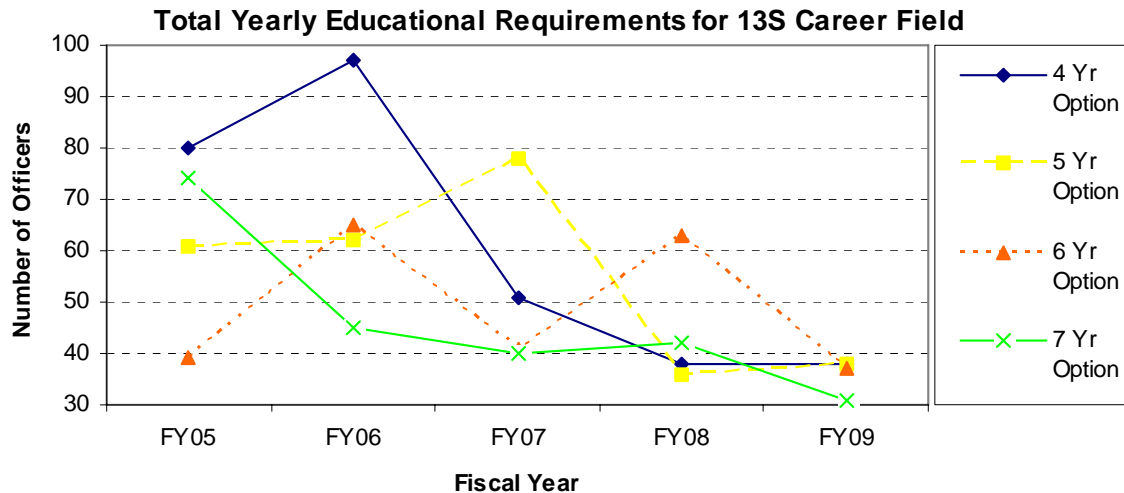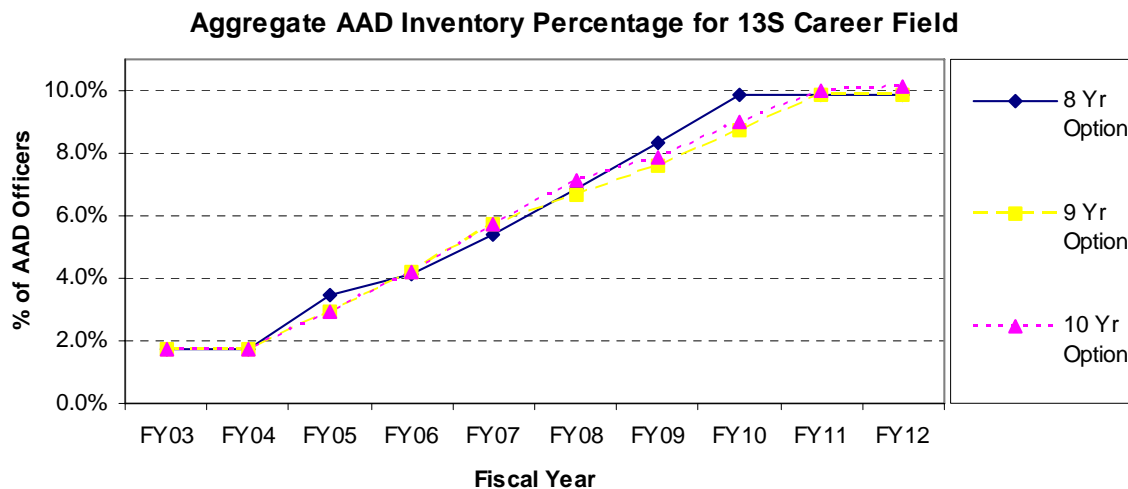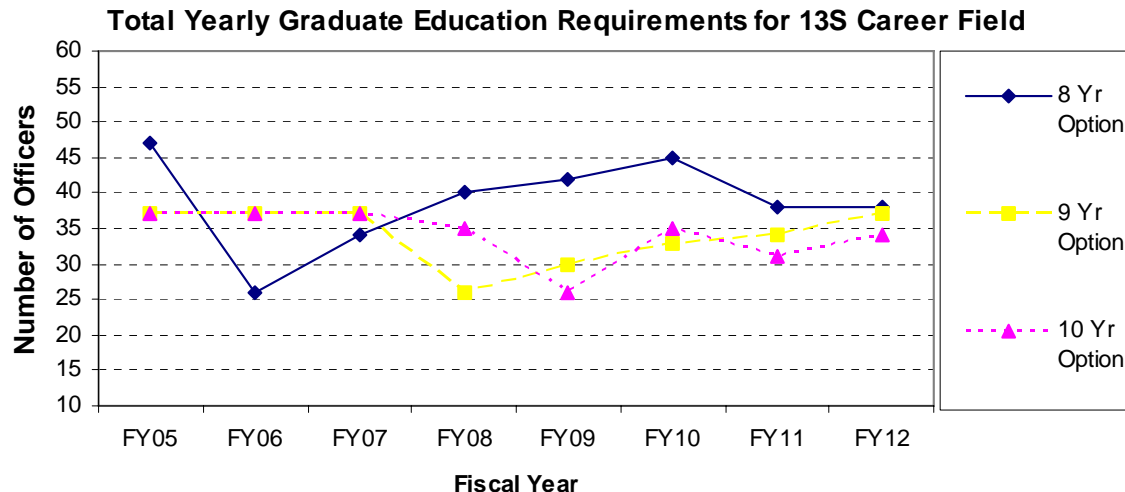
- Data Collection
  - Generate report with current profile status
  - Identify assignment availability of AAD inventory officers
  - Officers identify assignment preferences

- AAD Inventory Management
  - Match AAD officers to potential assignments
    - AAD-Only Assignments: e.g. AFIT Faculty
    - AAD-Profile Assignments: Satisfy unit profile requirements

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- Model should include Measures of Merit to indicate current health of AADIM process
  - % Weighted Average Incumbency of AAD-only assignments
  - % Weighted Average Incumbency of AAD-profile assignments
  - Overall measures and sub-measures by aggregation level and career field

- Model output: "Optimal" assignment recommendations
  - Sensitivity Analysis to show robustness of decision
  - Available "what if" analysis of assignment swaps

- Partition assignment characteristics into two categories
  - Required
    - Absolute must-haves
    - Prescreening
      – Grade
      – Security Clearance
  - Desired
    - "Goodness of fit" between an officer and an assignment
    - Desirable Attributes
      – Grade
      – Academic Specialty Code (ASC)
      – Security Clearance
      – Experience Level
      – Training Level
      – DT Vector
      – Officer Preferences

Modified Assignment problem

$$\text{maximize} \sum_{i=1}^{m} \sum_{j=1}^{n} p_j a_{ij} x_{ij}$$

$$\text{subject to} \quad \sum_{j=1}^{n} x_{ij} \leq 1 \;\; \forall \, i$$

$$\sum_{i=1}^{m} x_{ij} \leq 1 \;\; \forall \, j$$

$$x_{ij} = \begin{cases} 1 & \text{if officer } i \text{ is assigned to assignment } j \\ 0 & \text{otherwise} \end{cases}$$

p_j = relative assignment priority for assignment j

$a_{i,j}$ = qualification score for officer i with respect to assignment j

- Multi-attribute Additive Value Function

$$a_{ij} = V\left\{x_{ij}^1, x_{ij}^2, ..., x_{ij}^7\right\} = \sum_{a=1}^{7} k^a v^a(x_{ij}^a), \quad \forall (i, j)$$

$a_{i,j}$ = qualification score for officer *i* with respect to assignment *j*
k^α = relative weighting constant for attribute *α*

- Modeling Assumptions
  - Preferential independence between attributes holds
  - Each attribute has two levels
    - Meet the qualification, $v^\alpha(x^\alpha) = 1$
    - Does not meet the qualification, $v^\alpha(x^\alpha) = 0$
  - The weighting constants sum to 1 (Additive Independence)

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AADIM-U : Weighting Constants

- Conducted interviews with 61 DT members to examine two sets of weighting constants for the four attribute case

- Performed notional assignment matching experiments

Decision Maker 1

Attribute	Order	k^α
Experience and Training Level	1	0.444
DT Vector	2	0.222
Officer Preferences	2	0.222
Academic Specialty Code (ASC)	3	0.112

Decision Maker 2

Attribute	Order	k^α
Experience and Training Level	1	0.533
Academic Specialty Code (ASC)	2	0.267
DT Vector	3	0.133
Officer Preferences	4	0.067

Average Percentage of Identical Assignments for DM 1

Average Percentage of Identical Assignments for DM 2
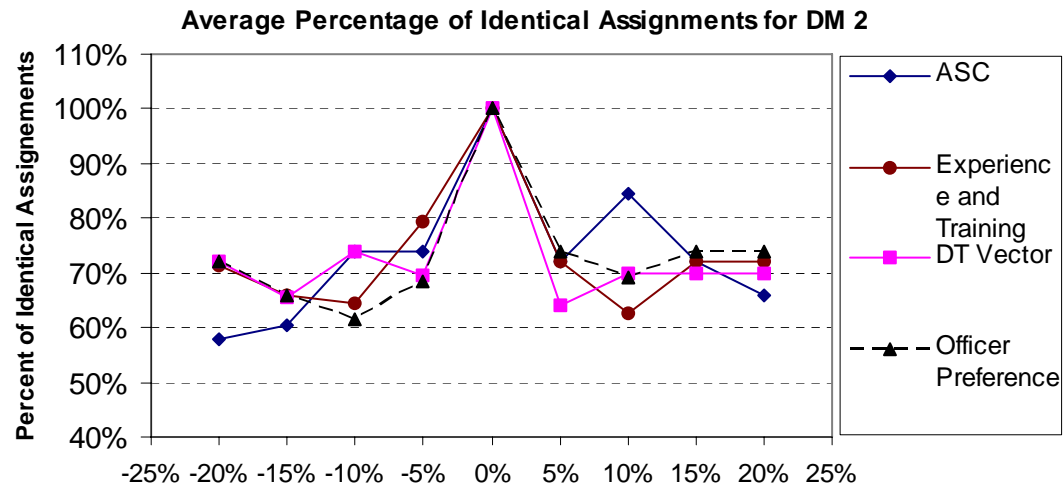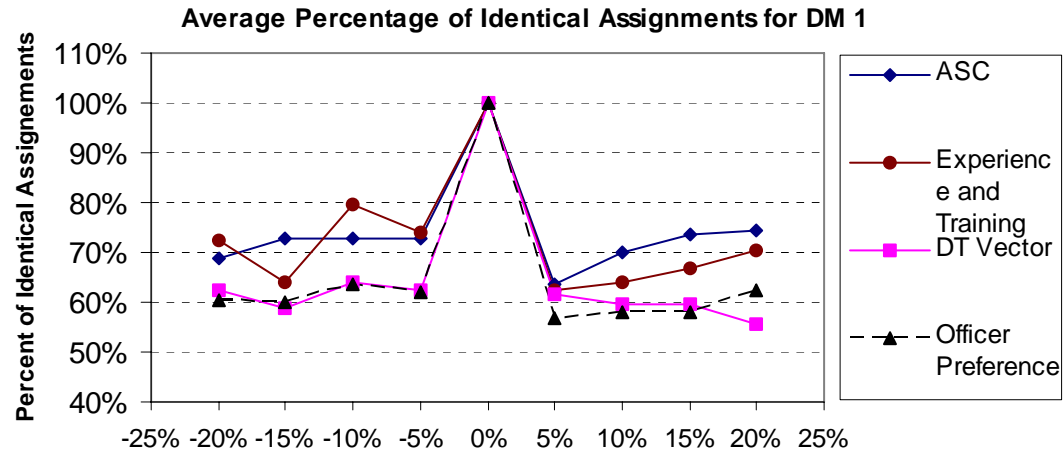
- AADIM-E
  - Capable of predicting long term education requirements
  - Useful to investigate different educational policies
  - Increasing the AAD inventory is a long term initiative

- AADIM-U
  - Provides a tool that matches AAD officers in AAD positions given a qualification score
  - The assignment matching is highly sensitive to the weighting constants
  - Flexible

- Manpower forecasting that does not rely on past policies

- More dynamic options for specifying graduate education policies

- Refinement of Job Qualification scoring tool

- Refinement of Multi-Attribute Value Function Weighting Constants

- Validation using data from actual assignment cycle

- Aggregation level for educational profiles--recommend Senior Rater ID
  - Senior Rater span of control is similar across AF

- Eliminates management of individual AAD <u>billets</u>
  - Key shortfall of current system
  - Compliance Issues with DODD 1322.10 and AFI36-2302

- Flexibility to assign new AAD inventory officers

- Flexibility for internal reassignments
  - Adaptability to rapidly changing unit requirements and missions
  - Supports officer development (e.g., progression from entry-level to supervisory positions)

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- Conceptual Approval
- Data Requirements
  - Preliminary 13S educational profiles
    - Current 13S-related AAD billets
    - 13S CFM & Development Team inputs
  - Current 13S AAD personnel assignments
    - By grade, YOS, and time-on-station (TOS)
- Model Development
  - AADIM-E
  - AADIM-M

- Comparison with 15W (Weather) Career Field
  - Education Goals are satisfied using current GEMS
- Career Field Guides
  - Add "technical & educational competencies"
  - Set expectation for officers to pursue advanced education

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Questions?